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Suite 700
Washington, DC 20001

May 16, 2018

VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

**Re: *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz,*
GN Docket No. 17-258; Expanding Flexible Use of the 3.7 GHz to 4.2 GHz Band,
*GN Docket No. 18-122***

Dear Ms. Dortch:

On May 14 and 16, 2018, representatives of Comcast and NBCUniversal met separately with staff from the Offices of Chairman Ajit Pai and Commissioners Carr and Rosenworcel, as detailed in Attachment A to this letter. During the meeting, we discussed the critical role C-Band satellite transmissions play in the video distribution ecosystem generally, and for Comcast and NBCUniversal in particular. We also described the innovation that continues to occur in the C-band, the ongoing need for this spectrum to accommodate new video technologies, and the limits of fiber as a full substitute for the ubiquitous coverage and reliability of C-Band satellites. Finally, we noted that any NPRM seeking comment on efforts to repurpose C-band spectrum should address the complex questions about potential impacts on the video distribution ecosystem. The attached presentation guided our discussion.

Please direct any questions to the undersigned.

Respectfully Submitted,

/s/ Brian M. Josef
Brian M. Josef
Comcast Corporation

Attachment

cc: Rachael Bender
Umair Javed
Kate Black
Will Adams

Attachment A

Meeting Attendees

May 14, 2018 – Office of Chairman Ajit Pai

Rachael Bender, Wireless and International Advisor to Chairman Ajit Pai

Mark Hess, Senior Vice President, Business and Industry Affairs, Comcast

David Don, Vice President, Regulatory Policy, Comcast

Angela Ball, Senior Counsel, Regulatory Affairs, NBCUniversal

Brian Josef, Executive Director, Regulatory Affairs, Comcast

May 14, 2018 – Office of Commissioner Jessica Rosenworcel

Umair Javed, Wireless and International Legal Advisor to Commissioner Jessica Rosenworcel

Kate Black, Media Policy Advisor to Commissioner Jessica Rosenworcel

Mark Hess, Senior Vice President, Business and Industry Affairs, Comcast

David Don, Vice President, Regulatory Policy, Comcast

Angela Ball, Senior Counsel, Regulatory Affairs, NBCUniversal

Brian Josef, Executive Director, Regulatory Affairs, Comcast

May 16, 2018 – Office of Commissioner Brendan Carr

Will Adams, Wireless and International Advisor to Chairman Ajit Pai

David Don, Vice President, Regulatory Policy, Comcast

Brian Josef, Executive Director, Regulatory Affairs, Comcast



Critical C-Band Operations

May 2018

The C-Band

- **Critical link in video distribution sourced from national and regional programmers**
 - 3.7-4.2 GHz band for downlink from satellites
 - 6 GHz band for uplink to satellites
- **Satellite service provides ubiquitous coverage, including rural areas that are difficult to serve using other technologies**
- **C-Band satellite transmissions ideally suited to point-to-multipoint video distribution**
 - Efficient, ubiquitous coverage, including difficult-to-serve rural areas
 - Robust resistance to rain fade
- **FCC estimated 4,700 earth stations, but number likely higher**
 - ACA indicates 90% unregistered, SES and SIA estimate over 33,000 total
 - FCC is appropriately seeking more accurate information through earth station registration window

Comcast Depends on Availability and Integrity of C-Band Satellite Links

- Comcast uses hundreds of C-Band receive earth stations at locations throughout the country
- Approximately 80% of video programming is received by Comcast via C-Band satellites
 - 6,600 distinct video services
 - 148 transponders
 - 20 satellites
- Comcast's "head-end in the sky" (HITS) service distributes programming to small and midsize MVPD headends in rural areas via C-Band
 - 270+ services
 - 39 programmer groups
 - 300 cable operators
 - 900 cable systems
 - 900,000 subscribers
- For example, nearly 700 Comcast programming services operate in the 3700-3800 MHz portion of the C-Band downlink
- The current constellation of C-Band satellites is heavily utilized
 - Approx. 86% of transponders on the 20 satellites utilized by Comcast carry full-time feeds

NBCUniversal Depends on Availability and Integrity of C-Band Satellite Links

➤ NBC Network

- 1 full C-Band transponder
- Video sent to approx. 240 C-Band earth stations at affiliate locations in each market
- **Serves 114 million households**

➤ Telemundo

- 1 full C-Band transponder
- Video sent to approx. 80 C-Band earth stations at affiliate locations in each market
- **Serves 14 million Hispanic households**

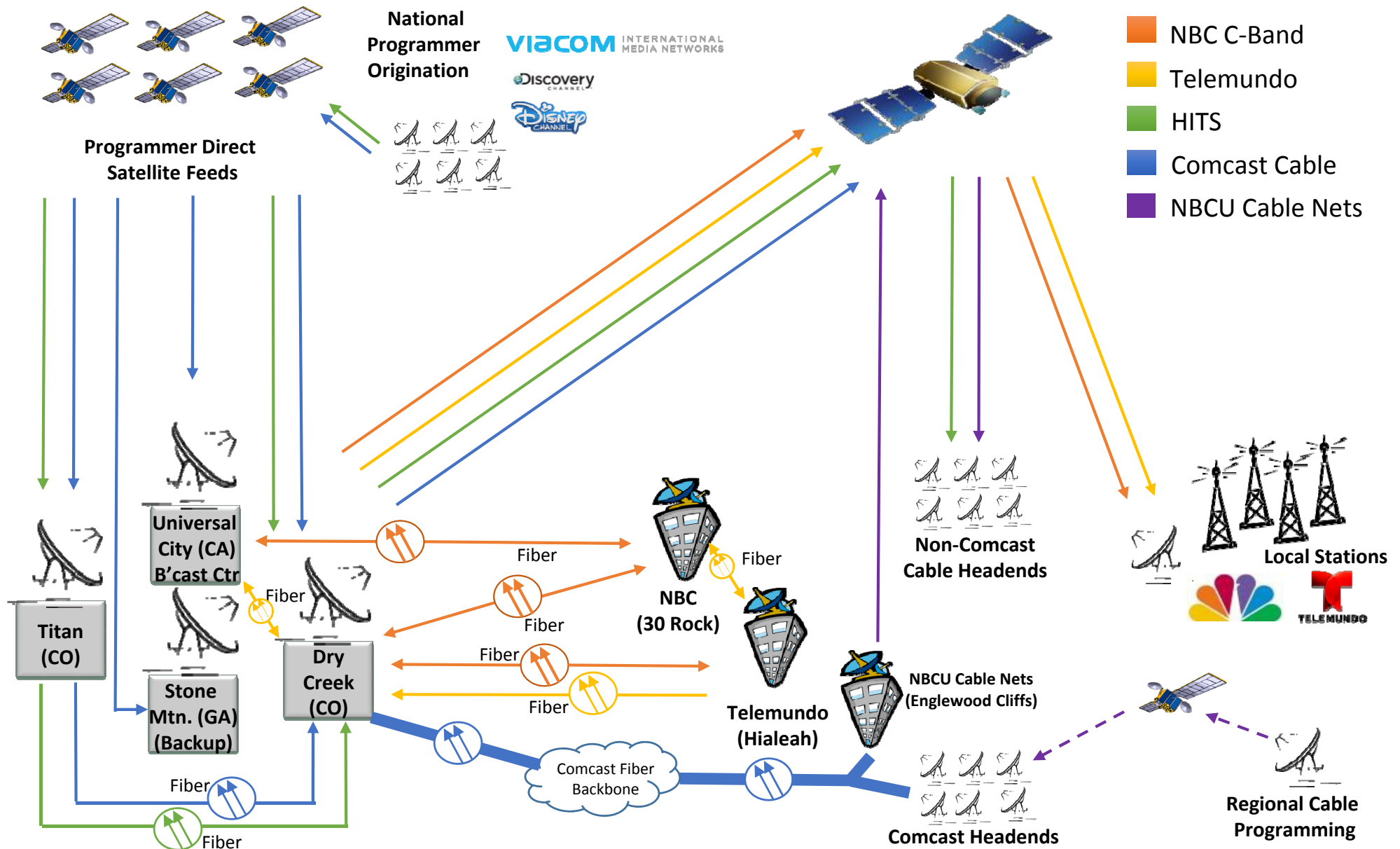
➤ NBCUniversal Cable Networks

- 11 full C-Band transponders
- Video sent to approx. 5,000 MVPD headends around U.S.
- **Serves 100 million households**

➤ Syndicated Programming

- 2 full C-Band transponders used for inbound distribution of syndicated programming to 11 NBC O&O stations **serving more than 32 million households**
- C-Band also used by outside vendors who deliver NBCUniversal's outbound syndicated programming to approximately 200 TV stations in U.S.

Comcast NBCUniversal Video Distribution



Satellite Video Distribution in the C-Band Continues to Evolve

- **Satellite technology has evolved to meet customers' increasing demands**
 - MPEG encoding advances yield compression rates from 3:1 to 9:1 or higher
 - Advanced modulation schemes increase spectral efficiency
 - 8PSK now used to carry HD feeds; implementation of 16ASK and 32ASK for Ultra-HD video coming
 - BUT, advanced modulation and encoding schemes are more sensitive to interference (i.e., require higher E_b/N_0 to meet maximum BER requirements)
- **Innovations are driving the need for more spectrum, not less**
 - Advances in programming / transmission technologies shift capacity demands.
 - Emergence of 4K and other high-bandwidth video technologies are driving demand for more C-Band capacity
 - 1 transponder = 20 SD channels = 8 HD channels = 4 UHD/4K channels
 - Likely need for more transponders to innovate
 - FCC decisions to reallocate C-Band spectrum should not bind deployment decisions that limit technologies consumers demand (e.g., HD, Ultra-HD)

The FCC's NOI Raises Questions About Potential Impacts of Repurposing the C-Band

- **If the FCC moves forward with an NPRM, it should consider the effects on video distribution in the U.S.**
- **If the FCC seeks comment on repacking the nation's video distribution services in less spectrum, it should address impacts on video transmission:**
 - Channel occupancy and power spectral density would increase, increasing risk of adjacent satellite interference at earth stations
 - Multiple carriers sharing a single transponder would increase, increasing risk of intermodulation interference or requiring additional transponder input back-off, and raising operational complexity
 - Signal quality (Eb/No) degradation of a few tenths of a dB can increase transmission errors (BER) by orders of magnitude
 - Equivalent portion of the 6 GHz spectrum would become underutilized, as downlink channels are paired with uplink channels

Fiber Is Not a Full Substitute for the C-Band

- **America's current fiber footprint is inadequate to take over for C-Band**

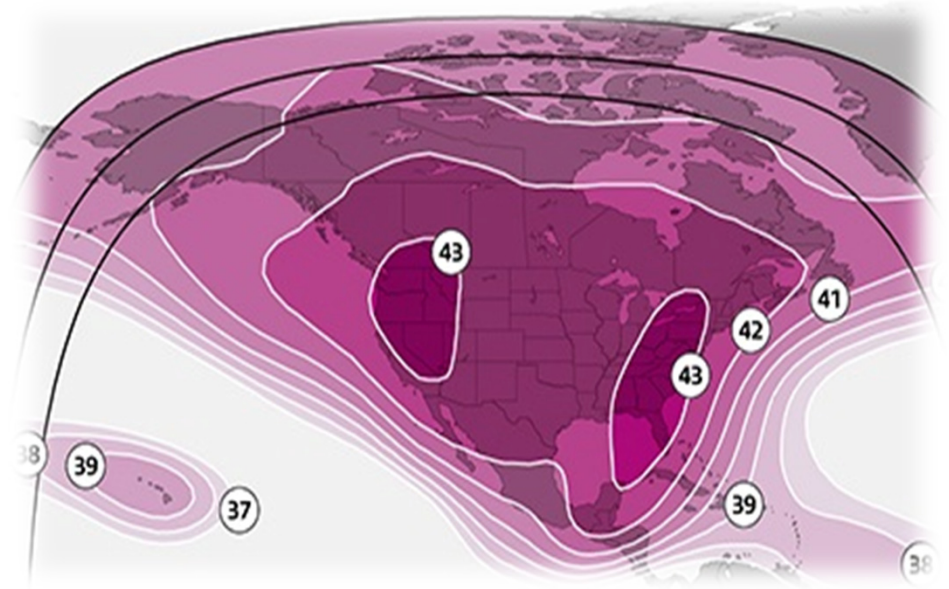


Source: T-Mobile Comments, GN Docket No. 17-183, at 14 & n.56.

- **To meet current consumer demands for reliability, duplicative and redundant fiber runs would be needed**
 - Comcast's experience shows few content providers using fiber as primary distribution due to fiber's inability to match C-Band's reliability, ubiquitous coverage and costs.
 - Handoffs from multiple fiber network vendors would likely be required, complicating service quality and reliability (e.g., SLAs).
 - Additional transaction costs and difficulty of determining cause of outages serve as further deterrent

C-Band Satellite Coverage is Ubiquitous and Uniquely Suited for Certain Applications

- **C-Band satellites cover 100% of the U.S.**
- **C-Band satellites enable remote programming**
 - Live news
 - Live sports
 - Portable uplink/downlink gear
 - Remote locations
 - Transmit location not known in advance



Source: SES